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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/708,642	03/17/2004	Chih-Chung Chuang	ADTP0066USA	2641

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EXAMINER	
GEORGE, PATRICIA ANN	
ART UNIT	PAPER NUMBER
1765	

SHORTENED STATUTORY PERIOD OF RESPONSE	NOTIFICATION DATE	DELIVERY MODE
3 MONTHS	03/09/2007	ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Notice of this Office communication was sent electronically on the above-indicated "Notification Date" and has a shortened statutory period for reply of 3 MONTHS from 03/09/2007.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

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Office Action Summary	Application No.	Applicant(s)	
	10/708,642	CHUANG ET AL.	
	Examiner	Art Unit	
	Patricia A. George	1765	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *04 January 2007*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-20* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☒ Claim(s) *13-15 and 17-20* is/are allowed.

6)☒ Claim(s) *1-12, and 16* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☐ The drawing(s) filed on _____ is/are: a)☐ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____.

DETAILED ACTION

Claim Objections

Claim 6 objected to under 37 CFR 1.75(c), as being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicant is required to cancel the claim(s), or amend the claim(s) to place the claim(s) in proper dependent form, or rewrite the claim(s) in independent form. Claim 6, recites the limitations of the dual metal layer exactly as claim 1 recites them.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.
>
> This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claim 1, 6, and 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong in view of Rioux of USPN 5,554,488 and Kim et al. (4,981,816).

Hong et al. discloses a front end array process for making LCD panel (col.1, l.7-11), comprising: depositing a molybdenum-containing metal gate layer which consists of gate lines, gate pads, and gate electrodes that can have a single or multiple layered

structure (as in applicants' claim 6, see fig. 3, 22, 24, 26 or col.10, l.55-67), and is deposited on a silicon substrate (fig. 2, 10 or col.1, l.34-37). Hong teaches the use of photolithography masking (ab.) followed by dry etch (i.e. uses gas mixture, col.7, l.15-45) to pattern the molybdenum-containing metal layer/s for forming both gate and data wire (i.e. word line, col. 11, l.20-25).

Hong's first embodiment teaches use of dual layers (as in applicants' claims 1 and 6) of Al-Nd and Mo-W, and it is known and preferable to use dry etch for this combination of materials (col.12, l.38-46).

Hong fails to teach substantially oblique sidewalls (as in applicants' claim 1).

Rioux teaches a conventional method of forming Mo containing (col.5, l.57) metal gate (col.5, l.49) with tapered sidewalls (i.e. oblique sidewalls), formed on the surface of a semiconductor substrate (i.e. glass; col.5, l.34-35), through use of well known photolithography and dry etch methods (col.6, l.51-59), as in claims 1, and 6.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the method of tapered sidewalls, of Rioux, when making the front end array process for making LCD panel, of Hong, because Rioux teaches it avoids undercutting, and etch damage in subsequent process (ab), an known process improvement.

Kim et al. teaches a preferred etch resolution is achieved using RIE of molybdenum, etched until gas is cut off at the detection of the molybdenum "end-point"

(see col. 3, lines 60-66), which is written on applicants' limitation etching molybdenum-containing metal layer is detected by an end-point detection method.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention making the front end array process for making LCD panel, of Hong, by including a step of etching molybdenum-containing metal layer is detected by an end-point detection method, as applicants' claim, because Kim et al. teaches it is a RIE method which achieves a preferred etch resolution9.

As to claim 7, Hong does not specifically point out top and bottom layers, as in applicants' claim 7, but Hong's first embodiment teaches use of dual layers of Al-Nd and Mo-W (col.12, l.38-46), as in applicants' claim 7.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to form LCD panels with gate layers of dual materials, as in Hong, by selecting the order of deposition of the layers, the Aluminum containing film being first, the bottom layer, and the Moly containing film being second, the top layer, because Hong teaches the combination of materials in that specific order AL-Nd, first, then Mo-W, second.

Claim Rejections - 35 USC § 103

Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong and Rioux (see discussions above) in view of both Kim et al. (US 2003/0122987) and Przybysz et al. (USPN 4,904,980).

The combined teachings of Hong and Rioux fail to disclose that dry etch includes an over etching when etching the Mo containing metal layer, as in claim 2.

Kim et al. teaches a fabrication method for forming an array substrate of a liquid crystal display. Kim teaches the over etching of Mo is known and common in prior art (p.0027, l. 4), as in claim 2.

Przybysz et al. teaches the overetch is commonly emplored during the etching of Mo because it is necessary, to allow time for the pattern to become fully defined (Description of the preferred embodiments -paragraph 4).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to combine the overetch, as taught by Kim in prior art, with the liquid crystal display invention, of Hong and Rioux, because both Kim and Prybysz indicate it is a conventional process that will allow time for the Mo-containg pattern to become fully defined, which avoids line defects.

Claim Rejections - 35 USC § 103

Claims 3, 9, 10, 11, and 12 are rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al. as applied above, in further view of Hori et al. of USPN 5445710.

The combined teachings of Hong and Rioux do not disclose the specific gas mixtures or ratio of claims 3, 9, and 10-12.

Hori et al. teaches dry etching method of a substrate containing carbon; patterning the film through a resist mask; using a gas plasma; with fluorine and O2

gases. Hori teaches an embodiment that includes chlorine, as well as fluorine and O2 gases. Hori teaches plasma etch with the presence of carbon atoms from a film. Hori also teaches etch gases containing fluorine atoms and oxygen atoms are mixed at an atomic ratio of fluorine to oxygen to 198:1 to 1:2. Hori's ratio range encompasses the range claimed in the instant invention. In example 3, Hori used a variety of gases with oxygen (O2-col.16, l.66), including: chlorine (Cl2-col.17, l.3), fluorine (SF6-col.17, l.3), and chlorine (Cl2) and fluorine (SF6) combined (col. l.18).

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the LCD manufacturing method, disclosed by Hong and Rioux, by modifying the etchant gas mixtures and ratios, as taught by Hori, because Hori teaches combinations that improve the results of dry etching (col.1, l.18).

Claim Rejections - 35 USC § 103

Claims 4 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Cheung et al. (USPN 5354417).

The combined teachings of Hong and Rioux are silent about the etching of a molybdenum-containing metal layer executed under a process pressure higher than 25 mTorr, as in claims 4.

Cheung teaches use of SF6, HBr (col. 2, l.63), and an oxygen containing gas (col.2, l.64) for an improved selective etching of a substrate (col.2, l.60) having molybdenum-containing layer (col.2, l.61). Cheung teaches the combination of Cl2 and

O2 is typical (col.1, l.21-22) but they cause problems including "reentrant" profiles (col.1, l.29-30). Cheung teaches the process pressure at a range of 1 mTorr to 300 mTorr when etching a molybdenum-containing metal layer, which is encompasses the range of higher than 25 mTorr, in claims 4.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to select an etch rate of greater than 25mTorr for etching the molybdenum-containing metal layer in the modified teachings of Hong because Cheung (5,354,417) illustrates such a pressure is effective for accomplishing the desired etch.

Claim Rejections - 35 USC § 103

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Celii et al. (USPA 10/282621).

The combined teachings of Hong and Rioux are silent about the dry etch being controlled by a source power, a bias power, process pressure, oxygen flow rate and flow rate of fluorine containing gas, as in claim 5.

Celii et al. teaches an exemplary approach to plasma etching that is bases on Cl2 and a fluorine gas, with an oxidizer such as O2, where he controls the process temperature (para.128, l.7). Celii teaches controlling the process pressure (para. 108, l.8), the source power (para.108, l.10) , and bias power para.108, l. 10-11), as in claim 5. Celii also teaches controlling gas flow rates (see pg. 9, tables 3-5) as in claim 5.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include that dry etch is controlled by source power, a bias

power, process pressure, oxygen flow rate and flow rate of fluorine containing gas, as taught by Celii, with the method for producing a liquid crystal display device that includes a matrix substrate, disclosed by Hong and Rioux, because Celii teaches alterations and modifications of various aspects will occur to others skilled in the art (para. 176, l.2-3).

Claim Rejections - 35 USC § 103

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Hong, Rioux, and Kim et al., as applied above, in further view of Nagata et al. (JP405067590A).

The combined teachings of Hong and Rioux fail to disclose the etching of the molybdenum-containing metal layer is detected by a detection method which will detect a wavelength of about 704 nm, as in claim 8.

Nagata et al. teaches the etching of a film that has a fluorocarbon with a peak of light emission in of about 700nm (ab.), which is very different than the ordinary resist wavelength of 480nm. Nagata teaches the use of a second material to conduct the etching and when the fluorocarbon film is exposed, an intensity of 704nm (ab.) is detected.

It would have been obvious to one of ordinary skill in the art at the time of invention was made, to include the end point detection method of Nagata, in an etch used to produce a liquid crystal display device, as disclosed by the invention of Hong

and Rioux, because Nagata teaches even when a stepped area exists and the etch rate is not uniform, the end point can be easily and accurately be detected.

Although, the modified reference of Hong does not teach an example using the material molybdenum, it would have been obvious to one of ordinary skill in the art at the time of invention was made, to modify the invention of forming the front end array process, as Hong, to include that molybdenum or molybedenum-containg material when forming the metal gate with tapered sidewalls (i.e. oblique sidewalls), formed on the surface of a semiconductor substrate (i.e. glass; col. 5, 1.34-35), because Rioux teaches use of molybedenum-containg material it is known to be functional and effective when used to form the metal gate with tapered sidewalls, formed on the surface of a semiconductor substrate. In absence of unexpected results it would be beneficial to use materials known to be effective and functional.

Reasons for Allowance

Claims 13- 15, and 17 - 20 allowed. Please see the office action, [redacted] of 07/17/2006 for examiner's statement of reasons for allowance.

Response to Arguments

Applicants argue, on page 6, that is the conductive layer of Rioux is not a molybdenum-containing metal layer, however the reference of Rioux clearly points out (in column 5, line 57) that the metal used, may be Mo (molybdenum) or it's silicide.

Applicants assert on pages 6-7, three reasons why the reference of Rioux does not establish motivation, with respect, examiner does not agree. Examiner believe that "Rioux" teaches a proper motivation in teaching a method that provides for a gate structure comprising a multilayer metal stack characterized by smoothly tapered sidewalls advantageously, avoids ion etch damage to the substrate surface surrounding the gate metal stack (ab.)

As to applicants' first point: that the present invention is relates to a method for fabricating liquid crystal display devices, Rioux otherwise teaches a method of forming a semiconductor structure: *LCD devices use arrays of thin film transistors (TFT) to control the display, which means LCD devices are semiconductors, therefore art toward semiconductor structures is relavant to LCDs. Also it is well known that LCDs are considered semiconductor devices, see the semiconductor glossary for semiconductor terms such as LCD.(http://www.semiconductorglossary.com/).*

To applicants' second point: for the method of Rioux (US 5,554,488), the conductive layer 46 is not originally present on the wafer substrate 30 but later deposited. On the contrary, the dual-metal structure (i.e. a conductive layer) of the present invention is on a flat, clean surface of a glass substrate. In other words, different layers are on different substrates: Applicants fail to claim a conductive layer originally present on the wafer, or a flat, clean surface of a substrate, therefore examiner does not find these arguments commensurate with the scope of the claimed language.

With respect to applicants' third assersion, along with applicants' arguement on page 5, that the amended limitations, of 1/4/2007 have not been taught or suggested in

the art rejection of 11/13/2006, examiner agree. Please see the new grounds of rejection above.

Conclusion

THIS ACTION IS MADE FINAL. Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Patty George whose telephone number is (571)272-5955. The examiner can normally be reached on weekdays between 7:00am and 4:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on (571)272-1465. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Patricia A George
Examiner
Art Unit 1765

PAG
02/07

NADINE G. NORTON
SUPERVISORY PATENT EXAMINER